

Claims

- [c1] 1. A method of removing harmful gases from an automobile exhaust containing NO_x , CO, and hydrocarbons the method comprising:
- contacting a NO_x trap composition with a first exhaust gas mixture at a temperature of at least 200°C, the first exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-lean condition and the NO_x trap composition comprising:
 - a precious metal;
 - a NO_x absorber material;
 - an oxide that inhibits the decrease in NO_x storing ability of the NO_x trap composition; and
 - a support material; and
 - contacting the NO_x trap composition with a second exhaust gas composition at a temperature of at least 200°C, the second exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-rich condition.
- [c2] 2. The method of claim 1 wherein the oxide that inhibits the decrease in NO_x storing ability of the NO_x trap composition is selected from the group consisting of oxides

of magnesium, oxides of manganese, and combinations thereof.

- [c3] 3. The method of claim 1 wherein the oxide that inhibits the decrease in NO_x storing ability of the NO_x trap composition is present in an amount from about 1 to 30% of the total weight of the NO_x trap washcoat.
- [c4] 4. The method of claim 1 wherein the oxide that inhibits the decrease in NO_x storing ability of the NO_x trap composition is present in an amount from about 5 to 20% of the total weight of the NO_x trap washcoat.
- [c5] 5. The method of claim 1 wherein the oxide that inhibits the decrease in NO_x storing ability of the NO_x trap composition is present in an amount from about 5 to 15% of the total weight of the NO_x trap washcoat.
- [c6] 6. The method of claim 1 wherein the NO_x absorber is selected from the group consisting of oxides of alkali metals, oxides of alkaline earth metals, oxides of rare earth metals, and combinations thereof.
- [c7] 7. The method of claim 1 wherein the NO_x absorber is selected from the group consisting of cesium oxide, praseodymium oxide, strontium oxide, barium oxide, and combinations thereof.

- [c8] 8. The method of claim 1 wherein the precious metal is a metal selected from the group consisting of platinum, palladium, rhodium, and combinations thereof.
- [c9] 9. The method of claim 1 wherein the NO_x trap composition is applied to a substrate.
- [c10] 10. The method of claim 9 wherein the substrate is cordierite.
- [c11] 11. The method of claim 9 wherein the NO_x trap composition is applied to the substrate by washcoating.
- [c12] 12. A vehicle exhaust system implementing the method of claim 1.
- [c13] 13. A thermally stable NO_x trap composition comprising:
a support material;
a NO_x absorber material;
an oxide selected from the group consisting of oxides of magnesium, oxides of manganese, and combinations thereof in sufficient contact with the NO_x absorber that a NO_x trap incorporating the NO_x trap composition has a NO_x storage efficiency of at least 5% at a temperature of 400°C after aging of the NO_x trap; and
a precious metal in contact with the NO_x material.
- [c14] 14. The composition of claim 13 wherein the NO_x ab-

sorber is selected from the group consisting of oxides of alkali metals, oxides of alkaline earth metals, oxides of rare earth metals, and combinations thereof.

- [c15] 15. The composition of claim 13 wherein the NO_x absorber is selected from the group consisting of cesium oxide, praseodymium oxide, strontium, barium oxide, and combinations thereof.
- [c16] 16. The composition of claim 13 wherein the precious metal is a metal selected from the group consisting of platinum, palladium, rhodium, and combinations thereof.
- [c17] 17. The composition of claim 13 wherein the oxide is present in an amount from about 1 to 30% of the total weight of the NO_x trap washcoat.
- [c18] 18. The composition of claim 13 applied to a substrate.
- [c19] 19. The composition of claim 18 wherein the substrate is cordierite.
- [c20] 20. A vehicle exhaust system comprising a NO_x trap that includes the composition of claim 13.
- [c21] 21. A method of removing harmful gases from an automobile exhaust containing NO_x, CO, and hydrocarbons the method comprising:

contacting a NO_x trap composition with a first exhaust gas mixture at a temperature of at least 200°C , the first exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-lean condition and the NO_x trap composition comprising:

- a precious metal;
- barium oxide;
- a oxide that inhibits the decrease in NO_x storing ability of the barium oxide; and
- a support material; and

contacting the NO_x trap composition with a second exhaust gas composition, the second exhaust gas mixture comprising exhaust gases from an internal combustion engine operating in a fuel-rich condition.